CLAIMS

What is claimed is:

1. A multiple epitope fusion polypeptide comprising the general structural formula (I):

$$(A)_x\text{--}(B)_y\text{--}(C)_z \qquad (I)$$

wherein

(I) is a linear amino acid sequence;

B comprises an amino acid sequence containing at least five amino acids which amino acids correspond to an antigenic determinant of a GapC protein;

A and C each comprise an amino acid sequence that is

(i) different from B,

(ii) different from the other, and

(iii) an amino acid sequence containing at least five amino acids, which amino acid sequence corresponds to an antigenic determinant of a GapC protein wherein said antigenic determinant is not adjacent to B in nature;

y is an integer of 1 or more; and

x and z are each independently integers wherein x + z is 1 or more.

2. The multiple epitope fusion polypeptide of claim 1, further comprising a signal sequence

3. The multiple epitope fusion polypeptide of claim 1, further comprising a transmembrane sequence.

4. The multiple epitope fusion polypeptide of claim 1, wherein A, B, and/or C are linked by one or more spacer sequences, wherein said spacers

(i) are amino acid sequences of from 1 to 1,000 amino acids, inclusive;

(ii) can be the same or different as A, B, or C; and

(iii) can be the same or different as each other.

5. The multiple epitope fusion polypeptide of claim 1, wherein A, B, and C each comprise epitopes from one or more species of bacteria.

6. The multiple epitope fusion polypeptide of claim 5, wherein A, B, and C each comprise epitopes from one or more bacterial species of the genus *Streptococcus*.

7. The multiple epitope fusion polypeptide of claim 6, wherein A, B, and C each comprise epitopes from one or more bacterial species selected from the group consisting of *Streptococcus dysgalactiae, Streptococcus agalactiae, Streptococcus uberis, Streptococcus parauberis,* and *Streptococcus iniae.*

8. The multiple epitope fusion polypeptide of claim 7, wherein A, B, and C each comprise amino acid sequences selected from the group consisting of

(a) the amino acid sequences shown at about amino acid positions 61 to 81, inclusive, of Figures 1 through 5, or any amino acid sequence having at least about 80% identity thereto;

(b) the amino acid sequences shown at about amino acid positions 102 to 112, inclusive, of Figures 1 through 5, or any amino acid sequence having at least about 80% identity thereto;

(c) the amino acid sequences shown at about amino acid positions 165 to 172, inclusive, of Figures 1 through 5, or any amino acid sequence having at least about 80% identity thereto;

(d) the amino acid sequences shown at about amino acid positions 248 to 271, inclusive, of Figures through 5, or any amino acid sequence having at least about 80% identity thereto; and

(e) the amino acid sequences shown at about amino acid positions 286 to 305, inclusive, of Figures 1 through 5, or any amino acid sequence having at least about 80% identity thereto.

9. The multiple epitope fusion polypeptide of claim 8, comprising the amino acid sequence depicted in Figure 6 (SEQ ID NO:22).

10. A polynucleotide sequence encoding the multiple epitope fusion polypeptide sequence of claim 1 or compliments thereof.

11. A polynucleotide sequence encoding the multiple epitope fusion polypeptide sequence of claim 2 or compliments thereof.

12. A polynucleotide sequence encoding the multiple epitope fusion polypeptide sequence of claim 3 or compliments thereof.

13. A polynucleotide sequence encoding the multiple epitope fusion polypeptide sequence of claim 4 or compliments thereof.

14. A polynucleotide sequence encoding the multiple epitope fusion polypeptide sequence of claim 5 or compliments thereof.

15. A polynucleotide sequence encoding the multiple epitope fusion polypeptide sequence of claim 6 or compliments thereof.

16. A polynucleotide sequence encoding the multiple epitope fusion polypeptide sequence of claim 7 or compliments thereof.

17. A polynucleotide sequence encoding the multiple epitope fusion polypeptide sequence of claim 8 or compliments thereof.

18. A polynucleotide sequence encoding the multiple epitope fusion polypeptide sequence of claim 9 or compliments thereof.

19. A recombinant vector comprising:

(a) the isolated polynucleotide of claim 10; and

(b) at least one control element operably linked to said isolated polynucleotide, whereby said coding sequence can be transcribed and translated in a host cell.

20. A recombinant vector comprising:

(a) the isolated polynucleotide of claim 11; and

(b) at least one control element operably linked to said isolated polynucleotide, whereby said coding sequence can be transcribed and translated in a host cell.

21. A recombinant vector comprising:

(a) the isolated polynucleotide of claim 12; and

(b) at least one control element operably linked to said isolated polynucleotide, whereby said coding sequence can be transcribed and translated in a host cell.

22. A recombinant vector comprising:

(a) the isolated polynucleotide of claim 13; and

(b) at least one control element operably linked to said isolated polynucleotide, whereby said coding sequence can be transcribed and translated in a host cell.

23. A recombinant vector comprising:

(a) the isolated polynucleotide of claim 14; and

(b) at least one control element operably linked to said isolated polynucleotide, whereby said coding sequence can be transcribed and translated in a host cell.

24. A recombinant vector comprising:

(a) the isolated polynucleotide of claim 15; and

(b) at least one control element operably linked to said isolated polynucleotide, whereby said coding sequence can be transcribed and translated in a host cell.

25. A recombinant vector comprising:

(a) the isolated polynucleotide of claim 16; and

(b) at least one control element operably linked to said isolated polynucleotide, whereby said coding sequence can be transcribed and translated in a host cell.

26. A recombinant vector comprising:

(a) the isolated polynucleotide of claim 17; and

(b) at least one control element operably linked to said isolated polynucleotide, whereby said coding sequence can be transcribed and translated in a host cell.

27. A recombinant vector comprising:

(a) the isolated polynucleotide of claim 18; and

(b) at least one control element operably linked to said isolated polynucleotide, whereby said coding sequence can be transcribed and translated in a host cell.

28. A host cell comprising the recombinant vector of claim 19.

29. A host cell comprising the recombinant vector of claim 20.

30. A host cell comprising the recombinant vector of claim 21.

31. A host cell comprising the recombinant vector of claim 22.

32. A host cell comprising the recombinant vector of claim 23.

33. A host cell comprising the recombinant vector of claim 24.

34. A host cell comprising the recombinant vector of claim 25.

35. A host cell comprising the recombinant vector of claim 26.

36. A host cell comprising the recombinant vector of claim 27.

37. A method for producing a multiple epitope fusion polypeptide, said method comprising culturing the cells of claim 28 under conditions for producing said polypeptide.

38. A method for producing a multiple epitope fusion polypeptide, said method comprising culturing the cells of claim 29 under conditions for producing said polypeptide.

39. A method for producing a multiple epitope fusion polypeptide, said method comprising culturing the cells of claim 30 under conditions for producing said polypeptide.

40. A method for producing a multiple epitope fusion polypeptide, said method comprising culturing the cells of claim 31 under conditions for producing said polypeptide.

41. A method for producing a multiple epitope fusion polypeptide, said method comprising culturing the cells of claim 32 under conditions for producing said polypeptide.

42. A method for producing a multiple epitope fusion polypeptide, said method comprising culturing the cells of claim 33 under conditions for producing said polypeptide.

43. A method for producing a multiple epitope fusion polypeptide, said method comprising culturing the cells of claim 34 under conditions for producing said polypeptide.

44. A method for producing a multiple epitope fusion polypeptide, said method comprising culturing the cells of claim 35 under conditions for producing said polypeptide.

45. A method for producing a multiple epitope fusion polypeptide, said method comprising culturing the cells of claim 36 under conditions for producing said polypeptide.

46. A vaccine composition comprising a pharmaceutically acceptable vehicle and the multiple epitope fusion polypeptide of claim 1.

47. A vaccine composition comprising a pharmaceutically acceptable vehicle and the multiple epitope fusion polypeptide of claim 2.

48.A vaccine composition comprising a pharmaceutically acceptable vehicle and the multiple epitope fusion polypeptide of claim 3.

49. A vaccine composition comprising a pharmaceutically acceptable vehicle and the multiple epitope fusion polypeptide of claim 4.

50. A vaccine composition comprising a pharmaceutically acceptable vehicle and the multiple epitope fusion polypeptide of claim 5.

51. A vaccine composition comprising a pharmaceutically acceptable vehicle and the multiple epitope fusion polypeptide of claim 6.

52. A vaccine composition comprising a pharmaceutically acceptable vehicle and the multiple epitope fusion polypeptide of claim 7.

53. A vaccine composition comprising a pharmaceutically acceptable vehicle and the multiple epitope fusion polypeptide of claim 8.

54. A vaccine composition comprising a pharmaceutically acceptable vehicle and the multiple epitope fusion polypeptide of claim 9.

55. The vaccine composition of claim 46, further comprising an adjuvant.

56. A method of producing a vaccine composition comprising the steps of (1) providing the multiple epitope fusion polypeptide of claim 1; and

(2) combining said polypeptide with a pharmaceutically acceptable vehicle.

57. A method of treating or preventing a bacterial infection in a vertebrate subject comprising administering to said subject a therapeutically effective amount of a vaccine composition according to claim 46.

58. The method of claim 57, wherein said bacterial infection is a streptococcal infection.

59. The method of claim 57, wherein said bacterial infection causes mastitis.

60. A method of treating or preventing a bacterial infection in a vertebrate subject comprising administering to said subject a therapeutically effective amount of a polynucleotide according to claim 10.

61. The method of claim 60, wherein said bacterial infection is a streptococcal infection.

62. The method of claim 60, wherein said bacterial infection causes mastitis.

63. Antibodies directed against the multiple epitope fusion polypeptide of claim 1.

64. The antibodies of claim 63, wherein said antibodies are polyclonal.

65. The antibodies of claim 63, wherein said antibodies are monoclonal.

66. A method of detecting *Streptococcus* antibodies in a biological sample, comprising:

(a) reacting said biological sample with a multiple epitope fusion polypeptide under conditions which allow said *Streptococcus* antibodies, when present in the biological sample, to bind to said sequence to form an antibody/antigen complex; and

(b) detecting the presence or absence of said complex, and thereby detecting the presence or absence of *Streptococcus* antibodies in said sample.

67. The method of claim 66, wherein said multiple epitope fusion polypeptide is the sequence of claim 1.

68. An immunodiagnostic test kit for detecting *Streptococcus* infection, said test kit comprising the multiple epitope fusion polypeptide of claim 1 and instructions for conducting the immunodiagnostic test.